

Racetrack Mapping

Engaging students in Mathematics & Geography

This paper reports on a classroom investigation of a sequence of cross-disciplinary mapping lessons undertaken by Grade Five students at Black Hill Primary, a Victorian State Primary School in Ballarat.



Calvin Tromp and Rob Davis lead us through a mapping task that engages students in significant learning in the final weeks of the year.

While this activity was broadly framed around Mathematics, there were also important elements from Geography, (a new emphasis in the Victorian Essential Learning Standards (VELS)), along with English and Technology that contributed to the experiences of students undertaking the tasks. In both the Geography and Mathematics domain of the VELS (Victorian Curriculum and Assessment Authority, 2006) the ability of students to make their own maps, as well as interpret features, is identified within the standards for Level 4 as appropriate for students at this level of schooling. Researchers such as Ottosson and Aberg-Bengtsson (2000, p. 193) have also identified that “from the early years of schooling, we need a basic understanding of and skill in using maps,” while Gerber (cited in van der Schee, 2000, p. 218) contends “that children become progressively more competent at map skills as they are exposed to map-work in the classroom.” Mapping should thus be a regular feature of primary classrooms throughout school years. Furthermore, findings such as those which have guided the development of “Rich Tasks” (Queensland Department of Education, 2001) in Queensland were also reviewed to assist the development of the classroom program. It was determined, for example, that the task needed to be

problem-based, have connections to the real world, and draw from a range of fields of knowledge. Finally, in this case, the activity needed to be intellectually engaging for students at a time of the year (December) when this is often a challenge.

Participants

The lessons were conducted in a class with a typical range of student ability, from a child needing an Integration Aide to some students working at Year 7 and 8 levels in Mathematics. All activities occurred in the students’ usual classroom with their usual teacher (CT) and teacher aide. A lecturer in primary school Science and Mathematics education (RD) from a nearby university also participated in classroom activities and assisted in the planning of the teaching program. All student names used in this report are pseudonyms.

Overview of activities

Bearing in mind the considerations outlined above, the following sequence of activities was developed. Some minor adjustments were made as the program proceeded, but the broad intentions of the

planning were enacted. First, satellite imaging software projected onto an Interactive Whiteboard was used to 'zoom in' on famous motor racetracks from around the world. Features such as straights, chicanes and tight corners were noted and discussed among the class. Students were also encouraged to lead discussions on what they were finding in the photographs. (See Figure 1).



Figure 1:
Examining race track features in satellite images

After this, students formed cross-ability groups and designed a racetrack using Multi-base Arithmetic Block (MAB) longs. They were told that small remote control cars would be driven around the tracks at a later stage. The student groups were limited in the area they could build the track, but otherwise had considerable freedom in the design process.

Following the completion of their tracks, each group was asked to sketch a map to represent their track as accurately as possible. Students were told another group would rebuild their track using only the map that they had produced. They initially attempted to draw their tracks on blank paper, which introduced them to the concept of capturing ideas and information for transmission to a third party. (See Figure 2).

When the students had completed this initial mapping exercise, the grid referencing system was introduced, with students laying strings of wool over the racetracks. Metre rulers provided the boundaries with the wool laid across at decimetre intervals as shown in Figure 3.

When the students had completed the grid systems over their tracks, they produced another map, this time onto graph paper that matched the actual grid system they had created.

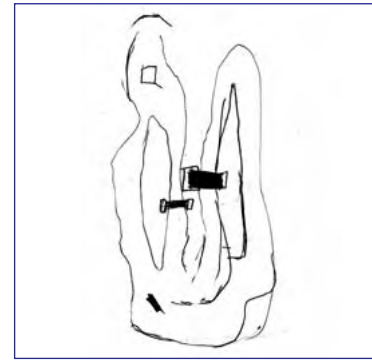


Figure 2:
Initial drawing of a racetrack



Figure 3:
Grid referencing for the racetrack models

These maps were compared with the earlier maps and students noticed that accuracy improved through the grid system, which was of particular concern to them considering the intention of the map as a means of communication to their fellow classmates.

Racetracks were then dismantled and the next day groups were given maps from another group which they were then asked to recreate. Students used masking tape to create a grid pattern on the classroom floor to guide their work. (See Figure 4). Following completion of this, the recreation was compared with photographs of the tracks in their original form. Considerable discussion was held between the original track designers and the group which attempted to recreate the tracks.

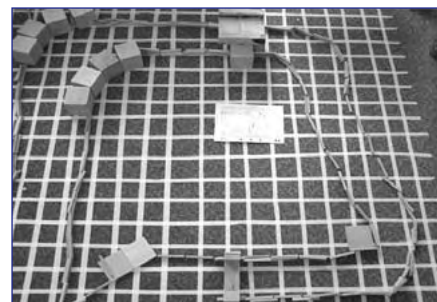


Figure 4:
Recreating racetracks from grid-referenced drawings

Finally, the students attempted to drive small remote controlled cars around the tracks. Class discussion on the suitability of the cars for the tracks also ensued, as outlined in Figure 5.



Figure 5:
Evaluating the tracks -racing remote control cars

Analysis

The lesson sequence was felt by the teachers to have been very powerful for the following reasons:

Purposeful

This lesson was not an academic exercise in map reading where the work would be written in exercise books never to be viewed again. Rather, these maps were going to be used to both communicate with others and provide a platform for the students to undertake the driving of the remote controlled cars at a later stage. The students experienced a major benefit of maps as a means to transmit knowledge across time to a third party. They were not allowed to help and guide in the rebuilding of the race courses and so care had to be taken. The purpose of the map as an artefact that requires a degree of accuracy, as well as conventions that are understood by all users, thus became apparent to the students involved as this was essential to the successful completion of the task.

Grid Referencing

Students gained a meaningful understanding of the benefits of having a grid overlay on maps. Indeed, some students extended the use of the grid system without any input from the teaching staff. For example, some students went as far as labelling the tape grid with a letter referencing system because

they found it a lot easier to draw and build the tracks (e.g., Phil (when rebuilding a track): “I need to add numbers and letters to make it easier”). This represents significant learning, as they saw the need and adopted the method independently. With the students working closely in groups, such insights were also shared between them and represent important social learning in the classroom. This is a far more powerful learning experience than students just learning how to read grid references off a published map.

Social interaction and cooperation

There were many instances of deep discussion and cooperation evident over the unit. The groups organised themselves and many assigned specific tasks to individuals. Discussions about such things as orientation of maps, relative location of objects in the maps, scaling issues, grid referencing, use of materials and certain race-track terminology (e.g. chicanes, pits) supported successful task completion. For this to be a meaningful exercise for all students the task had to be sufficiently challenging as well as accessible. A key to the success of this was to develop a task that could not be completed by one group member alone, and so cooperation and shared understanding of the task was essential to the group's overall success. In this way, the group strategies that worked most efficiently were ones that engaged the whole group in the task. All the children could be involved, from the integration student, who commented that, “This doesn't seem like maths; it's more like playing together”, through to the high ability children in the class who were challenged by the open-ended nature of many aspects of the task.

Use of mathematical/spatial language

Further examination of the language used by the children revealed phrases and language that demonstrated the benefit of the social learning approach adopted in this activity. Examples noted by the teachers include:

- That curves around this part here (refers to map and actual racetrack) - Andrew
- I need to make this part straighter (refers to map and actual racetrack) - Beth
- I need to count (the grid squares) - Charlotte
- It goes sort of like... (moves MABs around) - David
- The doubled longs weren't shown on the map so that's why we didn't build them... - Esther

The richness of such language use underscores the importance of developing social learning situations that are meaningful and intellectually engaging. By listening in on student discussions, the teachers were also presented with a myriad of opportunities to extend student learning, as well as to test understanding of the group.

Motivating, clear purpose and goal

Students were motivated throughout the unit because of links to their interests and the world outside the classroom and the promise of using their tracks to race cars around. (See Figure 5). It was also evident that students found the tasks to be intellectually engaging in their own right. Part of the reason for this may lie in the initial real world links developed through the use of satellite imagery software, and the fact that this then framed the task as having meaning beyond the classroom. While the task may have been conducted exclusively in a classroom, it was not 'artificial' in the sense of a bounded activity that lacked connections to the real world.

Readily available materials

The lessons requirements were graph and plain paper, MAB or other construction materials, wool or string, metre rulers and, of course, remote control cars. While the task was meaningful and intellectually rich, it was not dependent on exotic materials or large expenditures of money. The remote controlled cars, for instance, while not ideal, were purchased for \$20 from a local retail store.

Evaluation

The cars were frustrating to use as they were not easy to control and steer within the confines of the developed tracks. The students who drove slowly had more success than the fast drivers. Students commented that the tracks needed to be wider and this provided the opportunity to discuss that knowing the characteristics of the cars beforehand would have helped in the initial track design. This can be likened to an architect needing to understand a client's requirements for a successful house to be built and provides clear linkages to design and technology.

Overall the task undertaken by the students was most worthwhile. It would be recommended that similar approaches to the development of mapping skills are worth considering provided that they show explicit links to the real world, are based on social

learning situations and allow for students to develop and extend their own understanding of the methods used.

Taking it further

Other versions of this activity that teachers might wish to consider include

- Recreate some famous race tracks such as Bathurst, Daytona, Albert Park, Sandown
- Redesign the track to make it faster, slower or more challenging
- Redesign the track for different vehicles
- Instead of race tracks, consider a Treasure Island map where students build the island from another group's map

References

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